

Dec. 29, 1964

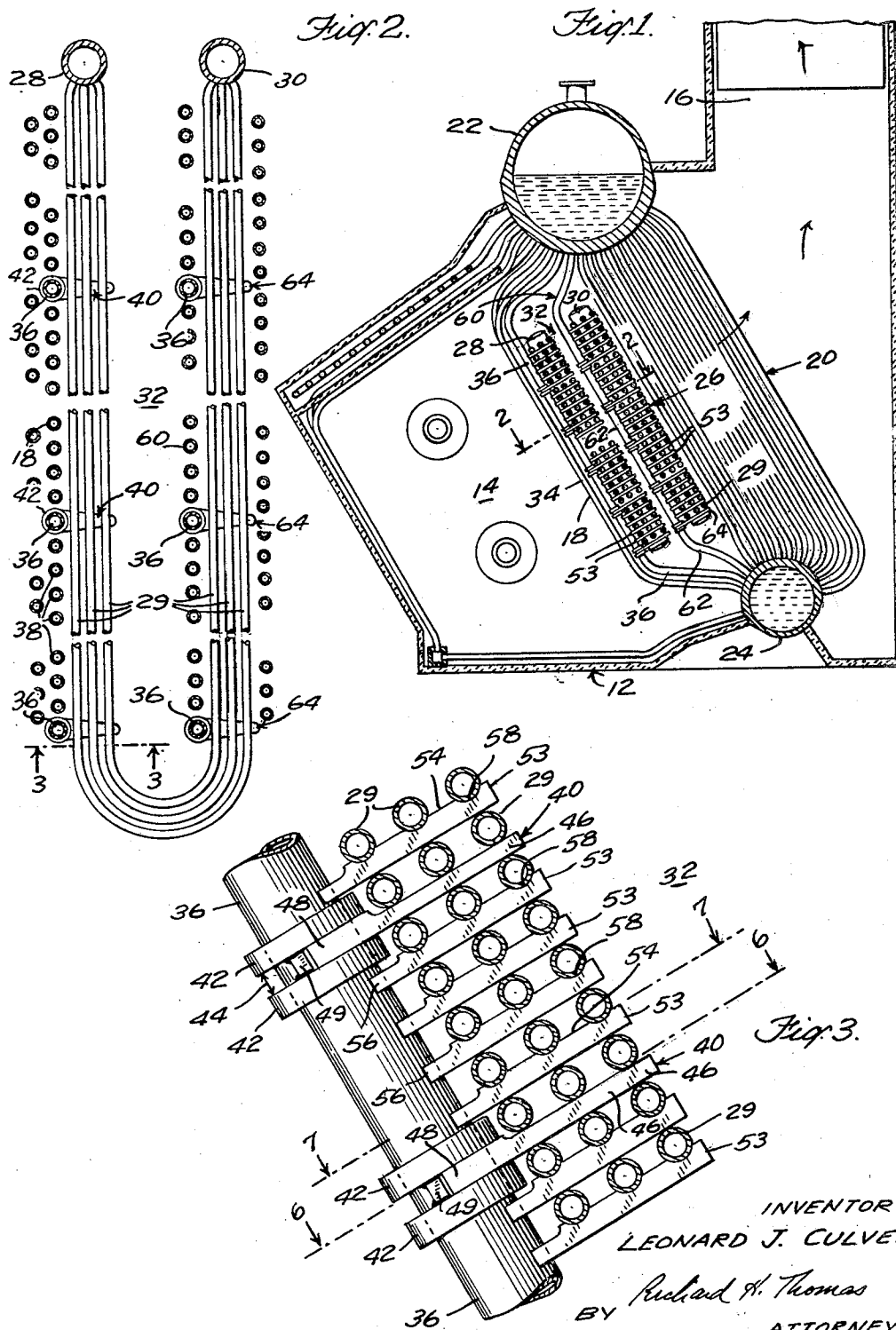
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TUBE SUPPORT ARRANGEMENT

Filed June 8, 1962

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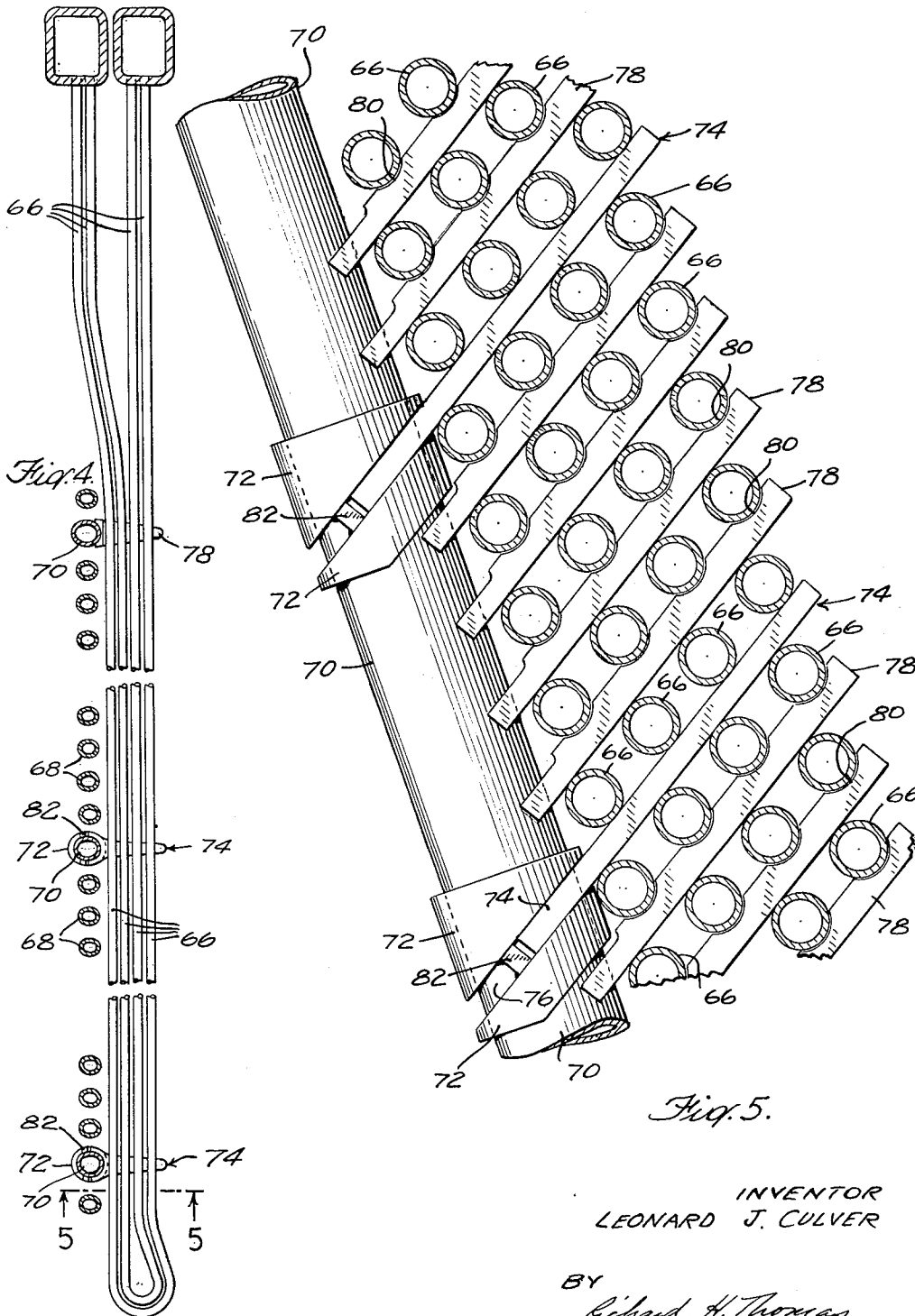
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Fig. 6.

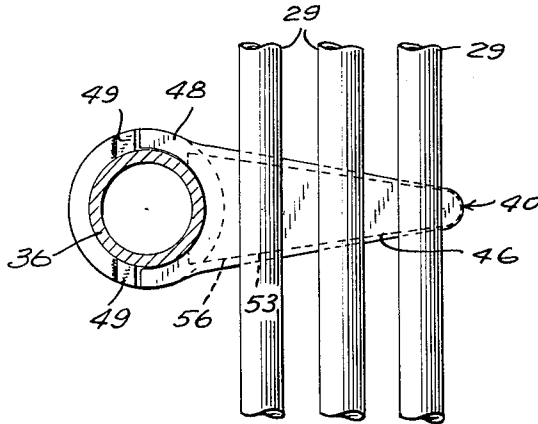


Fig. 7.

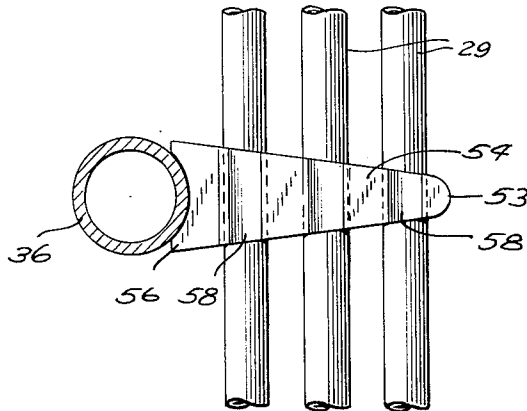
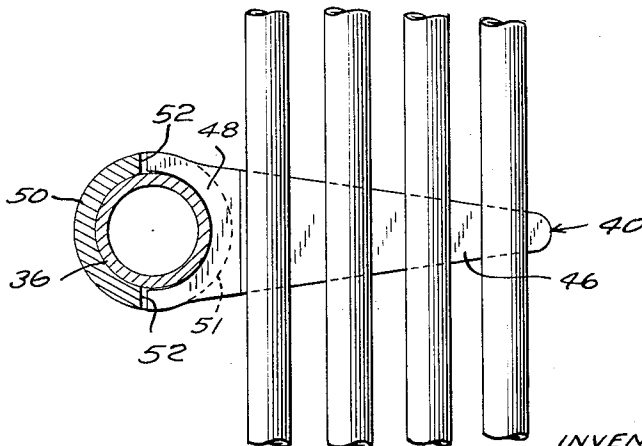


Fig. 8.



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TUBE SUPPORT ARRANGEMENT

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5 Claims. (Cl. 122-510)

This invention relates to tube supports for water-tube boilers, and in particular, to tube supports for superheater tubes of marine water tube boilers.

It is usual in water-tube boilers, and particularly in marine boilers, for a superheater to be provided in the vicinity of the main steam generating bank, and to consist of U-tubes which are supported by selected tubes of the steam generating bank. The supporting steam generating tubes are made over-size, i.e. larger and stronger than the others in the bank to enable them to function as supporting members. The support elements extending from the tubes usually take the form of plates projecting from hubs or collars surrounding and engaging the support tubes, the plates having holes drilled therein through which the superheater tubes pass.

After long service, these support plates are liable to waste away under the effect of the corrosive atmosphere to which they are subjected. They then have to be replaced and their replacement is a lengthy and laborious operation, which, it is the object of the invention to avoid.

According to the invention, the superheater tubes are supported on elements in the form of fingers or bars extending between rows of superheater tubes, the elements themselves being carried by the supporting steam generating tubes of the steam generating bank, which they embrace without surrounding them.

In a preferred form of the invention, the supporting tubes of the steam generating bank are provided at intervals along their length with pairs of support rings or collars, the two rings of a pair being set a short distance apart and their facing surfaces being parallel to each other but at an angle relative to the axis of the supporting tube on which they are mounted. The support elements themselves are in the form of fingers having the shape of a Y with a long leg extending between the rows of superheater tubes and a semi-circular yoke. The yoke is designed to embrace or straddle the supporting tube when it is inserted in the gap between the two members of a pair of support rings, and is of a thickness equal to the separation of these members.

When a support finger has been thus mounted, it is directed upwardly at an angle from the axis of the support tube so as to be retained in place partly by force of gravity and provides a shelf on which the superheater tubes are disposed. In order to prevent a support finger from turning around the axis of its support tube, one or a pair of stops can be arranged in the slot formed between the two support rings affixed to the steam generating tube.

It is not necessary to provide a pair of support rings for each row of superheater tubes. A pair of rings for use with a primary support finger can be provided for say every fifth or sixth row. For intermediate rows, fingers are provided which fit between successive rows and a but against the support tubes. Preferably their upper surfaces are grooved transversely to their length so that they are located by the superheater tubes which they support, and are prevented from turning in their own plane around the axis of the steam generating supporting tubes. Depending on the steam generator design and superheating tube arrangement, it may be desirable to dispose the support elements on a plane upwardly inclined relative to the supporting steam generating tubes. Because of the angularity of the support elements or fingers, the latter are held

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against turning round the axis of the support tube by the superheater tubes which they support.

Instead of using a pair of support rings as described above, a collar can be used in which has been machined a 180° slot making an angle with the axis of the support tube for receiving the yoke of a support finger. In this case, it is unnecessary to provide stops for preventing the support finger from turning as the ends of the slot perform the function of such stops.

It will be appreciated that as the fingers occupy only the space between successive rows for superheater tubes and the latter do not pass through them as they do through the conventional support plates, they can be easily removed whenever their replacement is necessary.

Other advantages of the invention will become apparent on consideration of the following detailed description and accompanying drawings, in which:

FIGURE 1 shows an elevation section view of a steam generator in accordance with the invention;

FIGURE 2 is an enlarged section view taken along line 2-2 of FIGURE 1;

FIGURE 3 is a further enlarged section view taken along line 3-3 of FIGURE 2;

FIGURE 4 is an enlarged section view corresponding to FIGURE 2 of an embodiment in accordance with the invention;

FIGURE 5 is a section view taken along line 5-5 of FIGURE 4;

FIGURES 6 and 7 illustrate in detail support elements in accordance with the invention, the views thereof being taken along lines 6-6 and 7-7 respectively of FIGURE 3; and

FIGURE 8 illustrates a support element in accordance with an embodiment of the invention.

Referring to FIGURE 1, a steam generator 12 in accordance with the invention consists of a combustion chamber 14 separated from a flue 16 by inclined banks of steam generating tubes 18 and 20 extending between a steam drum 22 and a water drum 24. The banks of steam generating tubes are spaced apart and a superheater 26 is positioned in the intermediate space, the superheater tubes being U-shaped and rows thereof extending from the front to the rear of the generator in parallel planes between inclined headers 28 and 30.

The superheater tube arrangement is more clearly illustrated in FIGURE 2. As shown, a row of tubes consists of three tubes 29 bent in the shape of a U and extending between headers 28 and 30. Preferably, the angle of bend is such as to provide a crawl space 32 between the straight portions of the tube.

As illustrated in FIGURES 1 and 2, the inner bank 34 of the steam generating tubes, i.e. the bank closest to the combustion chamber 14, has a spaced intervals supporting tubes 36 which are oversize, having thicker walls and being stronger than the other tubes 38 of the bank. In this instance, the supporting tubes 36 of the tube bank number three.

Extending from the supporting tubes in a direction towards the superheater bank and at an angle relative to the supporting tubes are support elements or fingers 40.

As illustrated in FIGURE 3, the support elements are upwardly inclined at right angles to the axes of the supporting tubes, but as will be seen later, different angles may be used. The length of the support elements, in this embodiment, is sufficient but limited to support, for each superheater tube row, the three tubes on one side only of the intermediate crawl space 32.

To hold the support elements 40 in place, the supporting tubes 36 are provided along their length with pairs of support rings or collars 42, welded or otherwise secured in place, the two rings being spaced apart a distance 44 and having their facing surfaces parallel to each other.

In this instance, the facing surfaces extend at right angles relative to the support tube 36.

The support elements, themselves, are in the form of fingers having the shape of a Y with a long leg portion 46 and a semi-circular yoke portion 48, FIGURES 2 and 6. The yoke is designed to embrace or straddle the support tube in the manner shown and to be seated in the gap 44 formed between the two rings or collars 42. The distance 44 between the rings is equal substantially to the thickness of the yoke 48 of the support element. By providing a close fit between the yoke portion 48 and the parallel facing surfaces of the rings 42, the latter extending at right angles to the axis of the tube 36, the support elements are also held at right angles relative to the supporting tubes.

To prevent the support elements from turning in their planes about the axes of the supporting tubes, one or a pair of stops 49 are secured in each slot between the two support rings and against the free ends of each yoke.

As an alternative arrangement for holding the support elements to the supporting tubes, a collar 50, FIGURE 8, can be machined having a 180° slot 51 arranged so that when the collar is slipped over and secured to a supporting tube, the slot will extend at a desired angle relative to the axis of the tube. The ends 52 of the slot in this instance function as stops for the yoke.

It should be noted that since the supporting tubes 36 are sloped or inclined so as to extend in a direction other than vertical, the support elements are also upwardly inclined and by their own weight engage the supporting tubes 36 and remain in place.

As previously indicated, it is not necessary to provide a pair of support rings for each row of superheater tubes. A pair of rings or a collar can be provided for every fifth or sixth row, depending on design considerations. Intermediate rows of tubes are supported by elements or fingers 53, FIGURES 3 and 7, inserted between successive rows, the upper and lower surfaces of the fingers being in contact or engaged by the rows. Each intermediate finger also has a straight portion 54 and a yoke portion 56, the latter engaging the supporting tube 36. The straight portion 54 preferably is provided with a grooved upper surface, the grooves 58 extending transversely to the length of the element and being adapted to seat or locate the superheater tubes which are supported. In this way, the elements or fingers are prevented from rotating in their plane around the steam generator supporting tube.

The arrangement as described supports only one side of each superheater tube row. The other side is supported by a similar arrangement, which includes a row of steam generating tubes 60, FIGURES 1 and 2, extending upwardly in the space 32 between sides and legs of the superheater. This row also is provided with spaced, stronger, thick-walled tubes 62 against which support elements 64 rest.

In a modified form of a steam generator, FIGURES 4 and 5, the superheater tubes may be bent as shown so that in the heating area the tubes are spaced approximately equal distances apart eliminating the crawl space or space between opposite legs or sides of the superheater tube rows. Again, the superheater tube bank is positioned adjacent to a steam generating tube bank, 68, provided with oversize supporting tubes 70. At spaced points along the supporting tubes, collars or support rings 72 are located retaining yoked support elements or fingers 74, similar to the elements 40 of FIGURE 3, the latter straddling the supporting tube in the groove or space 76 between support rings. The intermediate superheater tube rows, between rows supported by fingers 74, are held apart and supported by elements 78, similar to those shown in FIGURE 3, also yoke and straddling the supporting tube 70. These elements have grooved upper surfaces 80 engaging the superheater tubes and are there-

by restrained against lateral movement. Again stops 82 may be used to prevent movement of the primary elements 74.

Since the superheater tube rows are closely spaced, a single assembly or arrangement of supports may be used.

Other modifications will be apparent to those skilled in the art and within the scope and spirit of the invention. For instance, the free ends of the yoke portion of the support fingers or elements can, if desired, be tied together to prevent relative movement between the tubes and fingers. If desired, the support fingers can have different configurations and can be retained against the supporting tubes in different ways. Also, many devices are available for preventing sideways movement of the support fingers around the supporting tubes. Accordingly the invention is to be limited only as defined in the following claims.

What is claimed is:

1. An arrangement for supporting a plurality of spaced rows of superheater tubes in a boiler which includes a bank of upwardly extending water tubes having selected support tubes therein, comprising:

spaced pairs of support rings secured at intervals along the length of selected support tubes, each pair of said support rings tightly encompassing one of said selected support tubes and said rings of said pairs being closely spaced to form an opening therebetween, and

finger-like support elements having a Y-shaped yoke portion removably seated in said opening between the support rings of each pair and said finger-like support elements engaging said selected support tubes for supporting rows of superheater tubes, said rings of said pair being disposed so that the opening is upwardly oriented whereby the support elements are retained in place at least partly by force of gravity.

2. An arrangement for supporting a plurality of spaced rows of superheater tubes in a boiler which includes a bank of upwardly extending water tubes having selected support tubes therein, comprising:

cylindrical collars secured at intervals along the length of said selected support tubes, said cylindrical collars each tightly encompassing a single selected support tube and having approximately semicircular slots therein, and

finger-like support elements each having a Y-shaped yoke portion removably seated in said slots at an angle relative to said selected support tubes for supporting rows of superheater tubes, said Y-shaped yoke portion being semicircular in shape with approximately the same dimensions as said slot whereby the ends of said slots prevent rotation of said finger-like support elements about the selected support tubes in a plane substantially parallel to the longitudinal axis of said superheater tubes, said slots in said collars being disposed so that the slot is upwardly oriented whereby said support elements are retained in place at least partly by force of gravity.

3. An arrangement for supporting a plurality of rows of approximately horizontal superheater tubes in a water-tube boiler which includes at least one bank of upwardly extending steam-generating tubes having selected support tubes therein adjacent to said rows of superheater tubes, comprising:

spaced pairs of support rings secured at intervals along the length of selected support tubes, each pair of said support rings tightly encompassing one of said selected support tubes and said rings of said pair being closely spaced to form an opening therebetween,

primary finger-like parallel support elements having a Y-shaped yoke portion removably seated in said opening between the support rings of each pair and resting against selected support tubes to extend be-

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neath and support selected rows of superheater tubes, intermediate rows of superheater tubes being located between said selected rows of superheater tubes, said rings of said pairs being disposed so that said opening is upwardly oriented whereby said support elements are retained in place at least partly by force of gravity,

intermediate finger-like parallel support elements adapted to extend beneath and engage each intermediate row of superheater tubes between said selected rows of superheater tubes while resting upon the row of superheater tubes directly beneath the row of tubes being supported and to seat against said support tubes whereby said intermediate rows of superheater tubes are supported in part by said intermediate support elements seating against said selected support tubes and in part by the nearest of said primary support elements beneath said intermediate support elements, and

means for preventing rotation of said intermediate finger-like parallel support elements about said selected support tubes in a plane substantially parallel to the longitudinal axis of said superheater tubes.

4. An arrangement for supporting a plurality of rows of approximately horizontal superheater tubes according to claim 3 wherein said means for preventing the rotation of said intermediate support elements includes transverse grooves in a surface of said intermediate finger-like parallel support elements in which grooves said superheater tubes seat.

5. An arrangement for supporting a plurality of rows of approximately horizontal superheater tubes in a water-tube boiler which includes at least one bank of upwardly extending steam-generating tubes having selected support tubes therein adjacent to said rows of superheater tubes, comprising:

cylindrical collars secured at intervals along the length of said selected support tubes, said cylindrical collars each tightly encompassing a single selected support tube and having approximately semicircular slots therein,

primary finger-like parallel support elements having a Y-shaped yoke portion removably seated in said slots at an angle relative to said selected support tubes and resting against selected support tubes to extend beneath and support selected rows of superheater

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tubes, intermediate rows of superheater tubes being located between said selected rows of superheater tubes, said Y-shaped yoke portion being semicircular in shape with approximately the same dimensions as said semicircular slot whereby the ends of said slots prevent rotation of said finger-like support elements about the selected support tubes in a plane substantially parallel to the longitudinal axis of said superheater tubes, said semicircular slots of said collars being disposed so that said semicircular slot is upwardly oriented whereby said primary finger-like parallel support elements are retained in place at least partly by force of gravity,

intermediate finger-like parallel support elements adapted to extend beneath and engage each intermediate row of superheater tubes between said selected rows of superheater tubes while resting upon the row of superheater tubes directly beneath the row of tubes being supported and to seat against said support tubes, whereby said intermediate rows of superheater tubes are supported in part by said intermediate support elements seating against said selected support tubes and in part by the nearest of said primary support elements beneath said intermediate support elements, and

means for preventing a rotation of said intermediate finger-like parallel support elements about said selected support tubes in a plane substantially parallel to the longitudinal axis of said superheater tubes.

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